CLAIMS

What is claimed is:

1. In a flexible ureteropyeloscope having a control section and a shaft extending from the control section, the improvement comprising:

the shaft comprising a front end with a first active deflection section connected in series with a second active deflection section, the control section being adapted to independently deflect the first and second deflection sections, wherein the first and second active deflection sections are adapted to deflect such that a distal end of the ureteropyeloscope can be placed in a calyx of a lower pole of a kidney without the need to passively deflecting the front end of the shaft against tissue of the kidney of a patient to reach the calyx of the lower pole.

2. A flexible ureteropyeloscope as in claim 1 wherein the first active deflection section comprises a first shape-memory frame member having a general tubular shape comprised of superelastic material, and wherein the second active deflection section comprises a second shape-memory frame member having a general tubular shape comprised of superelastic material.

3. A flexible ureteropyeloscope as in claim 2 wherein the first frame member has a first array of slots therein and the second frame member has a second different array of slots therein.

4. A flexible ureteropyeloscope as in claim 3 wherein the slots of the first array extend into the first frame member in two opposite directions.

5. A flexible ureteropyeloscope as in claim 2 wherein the first and second frame members are connected to each other by a fitting, and an end of a control wire from the control section is fixedly connected to the fitting.

6. A flexible ureteropyeloscope as in claim 2 wherein the second frame member has a curved preshaped home position.

7. A flexible ureteropyeloscope as in claim 6 wherein the second frame member is maintained in a straight position by tension from a control wire from the control section.

8. A flexible ureteropyeloscope as in claim 1 wherein the first active deflection section is adapted to deflect in at least two opposite directions about 155°-190° with a radius of curvature of about 9-12 mm, and wherein a second one of the frame pieces forms a second active deflection section adapted to deflect in at least one direction about 125°-165° with a radius of curvature of about 9.5-13 mm.

9. A flexible ureteropyeloscope as in claim 8 wherein the first active deflection section is adapted to deflect in a first one of the at least two opposite directions a maximum of about 185° with a radius of curvature of about 10.6 mm, and is adapted to deflect in a second one of the at least two opposite directions a maximum of about 175° with a radius of curvature of about 11.3 mm.

10. A flexible ureteropyeloscope as in claim 9 wherein the second active deflection section is adapted to deflect a maximum of about 135° with a radius of curvature of about 10.6 mm.

11. A flexible ureteropyeloscope as in claim 10 wherein the first active deflection section has a length of about 3.6 cm and the second active deflection section has a length of about 2.8 cm.

12. A flexible ureteropyeloscope as in claim 1 wherein the control section comprises a first actuator for moving the first active deflection section and a second actuator for moving the second active deflection section, and at least one brake actuator, the at least one brake actuator comprising a first brake actuator being adapted to lock only the second active deflection section at a desired position.

13. A flexible ureteropyeloscope as in claim 12 wherein the at least one brake actuator comprises only the first brake.

14. A flexible ureteropyeloscope as in claim 1 wherein at least one of the active deflection sections comprises a series of ring members pivotably connected to each other.

15. A flexible ureteropyeloscope as in claim 1 wherein the shaft further comprises a section between the first and second active deflection sections.

16. A flexible ureteropyeloscope as in claim 15 wherein the section between the first and second active deflection sections comprises a passive deflection section.

17. A flexible ureteropyeloscope comprising:

a control section; and

a shaft extending from the control section, the shaft comprising a front end with two superelastic tube frame pieces connected in series, wherein a first one of the frame pieces forms a first active deflection section adapted to deflect in a first direction about 155°-190° with a radius of curvature of about 9-12 mm, and wherein a second one of the frame pieces forms a second active deflection section adapted to deflect in a direction substantially the same as the first direction about 125°-165° with a radius of curvature of about 9.5-13 mm.

18. A flexible ureteropyeloscope as in claim 17 wherein the first active deflection section is adapted to deflect in an opposite second direction about 90°-190°.

19. A flexible ureteropyeloscope as in claim 17 wherein the first active deflection section is adapted to deflect in a first one of the at least two opposite directions about 185° with a radius of curvature of about 10.6 mm, and is adapted to deflect in a second one of the at least two opposite directions about 175° with a radius of curvature of about 11.3 mm.

20. A flexible ureteropyeloscope as in claim 19 wherein the second active deflection section is adapted to deflect about 135° with a radius of curvature of about 10.6 mm.

21. A flexible ureteropyeloscope as in claim 20 wherein the first active deflection section has a length of about

3.6 cm and the second active deflection section has a length of about 2.8 cm.

22. A flexible ureteropyeloscope as in claim 17 wherein the first frame member has a first array of slots therein and the second frame member has a second different array of slots therein.

23. A flexible ureteropyeloscope as in claim 22 wherein the slots of the first array of slots extend into the first frame member in two opposite directions.

24. A flexible ureteropyeloscope as in claim 17 wherein the first and second frame members are connected to each other by a fitting, an end of a control wire from the control section being fixedly connected to the fitting.

25. A flexible ureteropyeloscope as in claim 17 wherein the second frame member has a curved pre-shaped home position.

26. A flexible ureteropyeloscope as in claim 25 wherein the second frame member is maintained in a straight position by tension from a control wire from the control section.

27. A method of positioning a distal tip of a flexible ureteropyeloscope in a calyx of a lower pole of a kidney comprising steps of:

bending a first active deflection section of a front end of a shaft of the flexible ureteropyeloscope; and

bending a second active deflection section of the front end of the shaft, the second active deflection

section being located behind the first active deflection section,

wherein the first and second active deflection sections are independently, controllably deflectable to locate the distal tip in the calyx of the lower pole without the need to passively deflect the front end against kidney tissue of the patient.

28. A method as in claim 27 wherein the first active deflection section comprises a first frame member having a general tube shape comprised of superelastic material, the second active deflection section comprises a second frame member having a general tube shape comprised of superelastic material, wherein the steps of bending the first and second active deflection sections comprise moving different control wires of a control section of the flexible ureteropyeloscope.

29. A method as in claim 27 wherein the step of bending the first active deflection section comprises bending the first active deflection section about 155°-190° with a radius of curvature of about 9-12 mm, and wherein the step of bending the second active deflection section comprises bending the second active deflection section about 125°-155° with a radius of curvature of about 9.5-13 mm.